CAI/ESF
(EXATRON STRINGY FLOPPY)

OPERATION MANUAL

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INTRODUCTION

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Congratulations on your purchase of the CAI Stringy Floppy for your Sinclair ZX81. You now own one of the most reliable mass storage devices ever introduced. You will be surprised as you learn of the flexibility and versatility of your new device.

The Stringy Floppy uses a special tape cartridge called a "Wafer" to store both programs and data. The tape is wound in a continuous loop, with a metal (foil) splice to mark the start of tape. The tape media is of high quality digital grade.

The CAI/ESF has three outstanding features:

1. SPEED-The CAI/ESF saves and loads programs from either the Timex 1000 or the Sinclair ZX81 at over 11000 baud. Compare this with the 250 baud of the present tape port. A 16K program can be loaded in approximately 15 seconds.

2. RELIABILITY-The CAI/ESF makes no compromises when it comes to storing and retriving data. It is built from the ground up to digital electronic standards; there are no knobs or switches to adjust. All program saves are fully verified after writing to insure accurate storage.

3. FLEXIBILITY-The CAI/ESF is menu driven which makes simple to operate, and yet it has the flexibility for the advanced programmer.

PLEASE READ THE ENTIRE INSTRUCTION MANUAL BEFORE INSTALLING OR USING THIS DEVICE.

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STRINGY FLOPPY FIRMWARE

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The software necessary to operate the CAI/ESF is provided on a 2716 EPROM (Erasable Programmable Read Only Memory) plugged into the CAI/O board. Read the following steps before installing the ESF firmware.

STEP 1 IMPORTANT-Read all the steps in this procedure before installing the EPROM.

STEP 2 Power Down the printer (If present).

STEP 3 Power Down the computer

STEP 4 Remove the CAI/O board from the computer.

STEP 5 Remove the four (4) screws from around the CAI/O case.

STEP 6 Lift the cover from the CAI/O board and expose the printed circuit board. NOTE the three (3) sockets for 24 pin IC's.

STEP 7 To prevent damage to the EPROM, first neutralize any charge differential between the CAI/O board and the EPROM by placing the EPROM and foam carrier on top of the CAI/O board, foam side down.

STEP 8 With the foam still resting on the CAI/O circuit board, remove the EPROM from the foam carrier. NOTE the alignment mark at the top of the EPROM (Do Not touch the pins).

STEP 9 Insert the EPROM in the middle socket with the alignment mark toward the rear of the CAI/O board. Be very careful and make sure that all pins are located in the IC socket correctly before trying to seat the EPROM. If all pins are located correctly, apply a gentle pressure to the EPROM until seated.

STEP 10 Reassemble the CAI/O board back into its case.

STEP 11 If you find this operation to difficult, CAI will install the EPROM for you for only the cost of shipping.

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STRINGY FLOPPY INSTALLATION

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STEP 1-Connect the ESF cable (Sixteen pin, multi-color) to the rear edge connector of the CAI/O board. BE SURE CONNECTOR IS RIGHT SIDE UP.

STEP 2 Connect the other end of the cable to the SF (Stringy Floppy) device. NOTE THAT THERE ARE TWO CONNECTORS ON THE END OF THE CABLE. EITHER CONNECTOR CAN BE USED. IF YOU WISH TO USE A SECOND DRIVE THE SECOND CONNECTOR IS USED.

STEP 3 Connect the second connector to the second drive, if present.

Your CAI/ESF should now be operational. The following section will demonstrate the system check-out procedure.

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PROGRAM MENU

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The CAI/ESF has a operation menu that is used to SAVE, LOAD programs, select each drive, and to format and certify a wafer. To call the ZX81 ESF MENU use the following command:

```
     PRINT USR 10240*          (ENTER)
```

*USR is a function, and is accessed by pressing SHIFT ENTER followed by L.

When this command is entered into the computer the screen will display the following Menu:

```
  ZX81 ESF MENU

     1  LOAD
     2  SAVE
     3  CERTIFY
     4  BASIC
     5  SELECT DRIVE
```

Each of these will be discussed in the following sections.

****

CERTIFICATION OF A WAFER

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<u>WRITE PROTECT</u> Please note that there is a small dot of material covering the paper shield. This circle is the WRITE PROTECT for the wafer. If the paper dot is over the black line the write protect is off. If it is removed this will expose the black line and WRITE PROTECT the wafer.

Each wafer must be certified before using. The purpose of certification is to determine if the tape media is OK and to determine the total number of bytes that can be stored on the tape.

THE WAFER YOU HAVE RECEIVED WITH YOUR CAI/ESF HAS ALREADY BEEN CERTIFIED AND CONTAINS TWO PROGRAMS. DO NOT CERTIFY THIS WAFER OR YOU WILL ERASE THE PROGRAMS.

The Wafer is certified by choosing option 3 from the ZX81 ESF MENU. The computer will then ask you for the FILE NUMBER. Just press ENTER. The computer screen will go blank and the motor light will come on. The second light will also come on when data is written to the tape during the formating of the waffer. The formatting is verified and a total byte count determined. The byte count will then be displayed on the screen just above the menu. If a specific file number is entered the Certify routine will start at that file and erase and Certify to the end of the tape.

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SAVING A PROGRAM

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Now that the wafer is certified it is ready to accept a program. This can be done by either loading an exsisting program into the computer's memory or creating one and then transferring it to the the CAI/ESF. The following steps outline this procedure:

STEP 1 From the Stringy Floppy menu, you will have to return to BASIC. Option 4 is selected by pressing the number 4. The K cursor will now appear at the bottom of the television. The computer is now in its normal BASIC mode.

STEP 2 Now load a program into the computer's memory. Then enter the Menu call command:

```
     PRINT USR 10240  (ENTER)
```

This will recall the ESF menu without effecting the program in memory.

STEP 3 Select option 2 SAVE by pressing the number 2.

The computer will now ask for which file. Enter the next available file number.

The programs are saved by number. You must be careful not to use the same number again as this will erase the existing program on the tape. You should keep a record of what has been stored on the tape. Press ENTER after file name. The television screen will go blank for a short period of time. When the program has been saved the computer will return to the menu. If the program did not store correctly the computer will return to the menu mode and display one of the following error codes on the television screen:

BREAK-The break key was pressed before operation was complete

PR-Parity error. Defective PROGRAM/DATA write.

CK-Checksum error. Defective write.

EOF-End Of File error. Tried to read/write on foil space
TRIED TO READ UNCERTIFIED WAFER

TT-Tape to short to store progam and physical problem with tape.

VF-Verify error.

WP-The Write protect for the tape has not been removed, no power to the system or bad cable. (FILE NOT FOUND) NOT CERTIFIED

OM-Out of memory. Program/Data is too large.

Whenever a program has been saved, the computer returns to the menu mode. If you wish to return to Basic and run the program press 4, followed by RUN and ENTER.

****

LOAD A PROGRAM

****

The following procedure may be used to LOAD a program from the CAI/ESF to the computer:

STEP 1 Call the ESF menu to the television screen by the following command:

```
     PRINT USR 10240          (ENTER)
```

STEP 2 Press number 1 for "LOAD". The computer will ask for the file number. Enter the number of the file you wish to load and press ENTER.

STEP 3 The screen will go blank for a few seconds. When the program has been loaded into memory the computer will return to the menu.

STEP 4 To review the program press option 4 (BASIC) on the menu and the computer will return to the basic mode. You can now LIST or RUN the program.

****

BREAK AND ESCAPE COMMANDS

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The CAI/ESF program has two ways to interupt a command:

<u>BREAK</u>-Break is used to halt a load in progress. This command is initiated by pressing either the BREAK/SPACE or ENTER key. This will abort the load and return the computer to the ESF menu.

<u>ESCAPE</u>-This function will allow you to escape before you enter a file or drive number. Just touch "X" and the computer will return to the ESF menu.

PROGRAM CHAINING

The CAI/ESF software has been designed with the ability to "CHAIN" programs. This means that one program can cause another program to be brought into the computer from the ESF and run automatically. Very large applications can be developed in segments, which will execute independently of each other while sharing all variables (data). Program chaining is accomplished in a BASIC program using the following sequence:

```
10 REM PROGRAM CHAINING DEMO
20 CLEAR
30 POKE 16390,2
40 POKE 16451,1
50 LET X= USR 10243
```

The POKE 16390,2, in line 30, tells the ESF software the file number (file 2) of the program desired. The next POKE to 16451,1 defines which of the six (6) functions is requested. Function code 1 means "chain programs".

Line 40 does the actual chaining operation. The chaining is accomplished by a machine-language CALL (similar to GOSUB) to memory location 10243, which is part of the ESF's operating program.

NOTE: If location (16451) does not contain a code from 1 to 8 upon calling USR 10243, a return to the current BASIC program is made with no operation attempted.

The following are the function codes and their meanings:

CODE	DESCRIPTION
1	LOAD in a BASIC program and RUN the program.
2	SAVE the current program, then return to menu.
3	CERTIFY the current Wafer.
4	No operation attempted
5	Select drive 1 or 2
6	Write all variables to a data file
7	Not used
8	Read in Variables from data file

NOTE: When chaining or saving progams, all variables are lost. To preserve variables, store them in a data file prior to program chaining. Let the object program retrive the variables from the file.

READING AND WRITING DATA FILES

The CAI/ESF has a simple but powerful method of data I/O built into the system. The SF stores the complete variable area. Although the method does not store individual variables, the method is highly efficient as only one SF file is written. The following programs demonstrates a simple case of DATA I/O; more complex programs can be developed. NOTE that the "Program Chaining" feature is also utilized.

THIS PROGRAM IS STORED IN FILE #1

```
 10 PRINT "ENTER A LINE OF TEXT"
 20 INPUT D$
 30 POKE 16390,3
 40 REM STORE IN FILE NUMBER 3
 50 POKE 16451,6 =STORE VARIABLES
 60 LET X=USR 10243
 70 PRINT "DATA SAVED....GOING TO PROGRAM 2"
 80 PAUSE 100
 85 CLEAR
 90 POKE 16390,2  FILE # 2
100 POKE 16451,1  LOAD BASIC PROG & RUN
110 LET X=USR 10243
```

THIS PROGRAM IS STORED IN FILE #2

```
 5 CLEAR
10 DIM A (100)
15 PRINT "GET READY"
20 PRINT "RETRIVING DATA FILE...."
30 PAUSE 100
40 POKE 16390,3
50 POKE 16451,8
60 LET X=USR 10243
70 PRINT "THE DATA IS........"
80 PRINT D$
```

Program 1 will write the D$ data you have entered (and any variables) into file #3. Program #2 will then execute and retrive the contents of file #3.

The following is a description of the programs:

PROGRTAM 1

Line 30 Sets file #3 as the storage file.
Line 50 Selects function 6. Save all variables to the data file.
Line 60 Call the CAI/ESF software.
Line 90 to 110 Loads in second progam from File #2 and runs it.

PROGRAM 2

Line 5 Clears the variable area in the computer. This statement is Very Important and must be used.
Line 10 Reserves the space in the variable table. This must be done before attempting to load any variables.
Line 40 Set file #3 as the retrieval file.
Line 50 Selects the function read variables from data file.
Line 60 Executes the READ at the correct memory location.

NOTE: Why the statement "10 DIM A(100)" ? This is an easy way of reserving space in the variable table. It reserves 500 bytes, more than enough for this data file. It does not matter how large you reserve; any extra space is cleaned up by the CAI/ESF firmware.

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ASSEMBLY LANGUAGE OPERATIONS

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The CAI/ESF firmware contains many useful routines to aid assembly language programming on the ZX81. In order to use this section a knowledge of assembly language programming is essential.

Most of the functions are to be treated as subroutines; they are called from other machine language programs. They end with the RET instruction.

FUNCTION	CALL ADDRESS	PARAMETERS (If any)
MENU	2300	None: Returns control to menu mode.
LOAD-FILE	2309	ENTRY: AF=File number BC=Max File length HL=Buffer Address EXIT: Z=1, Successful Z/1, Error Code in A.

Z/1, Error Code in
A.

C=0, Data BASIC
program file.
BC=Actual file length
C=1, Machine language
file.
HL=Start Address
BC=Length
DC=Autostart

* * *

SAVE DATA FILE 280C
(also writes EOF)

ENTRY: AF=file number
BC=Length
HL=Buffer

EXIT: Z=1 Successful
Z=0 Error code in
A.

* * *

SAVE-MACHINE 2815

ENTRY: A=File Number
BC=Length
DE=Autostart
HL=Buffer

EXIT: Z=1, Successful
Z=0 Effor code
in A.

This routine does not verify or write EOF marker. User must perform these tasks if desired. User must position tape to the correct position before calling the subroutine.

* * *

VERIFY 2812

ENTRY: A=File Number
HL=Buffer

EXIT: Z=1, Successful,

else error code
A.

Use to verify type of file.

* * *

POSN 2806

ENTRY: A=File Number

EXIT: Z=1, Successful
Z=0, Error in Code
A.

Use to Position tape for read/write.

* * *

****

WEOF   230F   ENTRY: A=File number.

Used to write the EOF marker.

****

INPUTN   2821   ENTRY: HL="prompting String"

EXIT: C=1, User pressed "X" key.
C=0, BC= Number entered

Use to input 2-byte integers decimal fashion.

****

BSPRN   2824   ENTRY: HL=Number to print.

Use to print decimal numbers 0-65535.

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SELECT   281E   A=Drive Number

****

KYLOOP   2827   Scan KB(Keyboard) for a Key.

****

NEWB   2818   A=File Number

****

****

LOADING A MACHINE CODE PROGRAM

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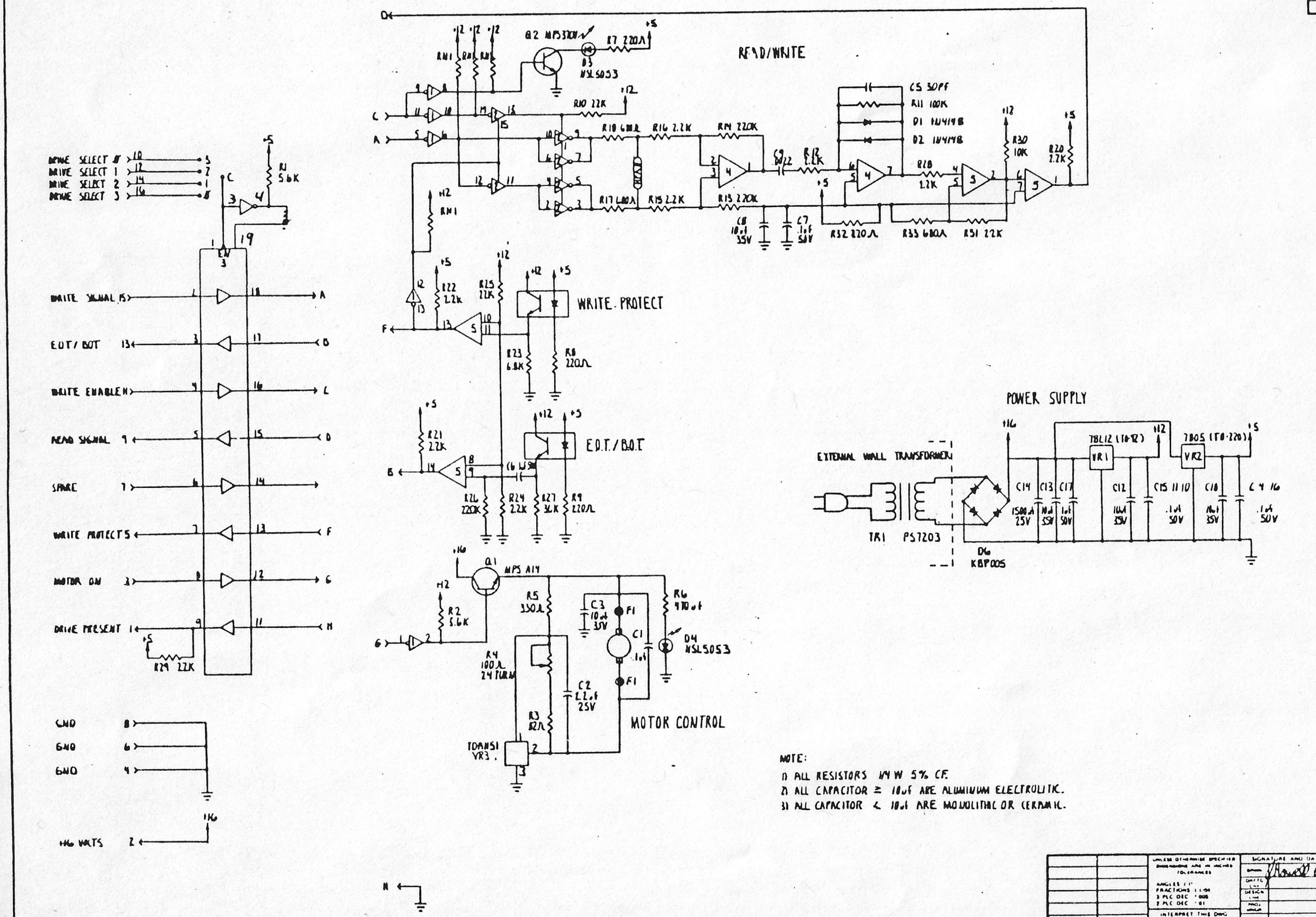
The procedure for loading a machine code program is exactly the same as loading a basic program. After loading, however, control will transfer to the "AUTOSTART" of the machine language program. If you write your own machine language programs and wish to return to the menu make the AUTOSTART=10240.

REVISIONS			
APPROVED	DATE	ECN NUMBER	REV


READ/WRITE
WRITE PROTECT
E.O.T./B.O.T.
MOTOR CONTROL
POWER SUPPLY
DRIVE SELECT 0 10
DRIVE SELECT 1 12
DRIVE SELECT 2 14
DRIVE SELECT 3 16
WRITE SIGNAL 15
EOT/BOT 13
WRITE ENABLE N
READ SIGNAL 9
SPARE 7
WRITE PROTECT 5
MOTOR ON 3
DRIVE PRESENT 1
GND 8
GND 6
GND 4
+16 VOLTS 2
R1 5.6K
R29 22K
EN
A
B
C
D
E
F
G
H
Q2 MPS3704
D3 HSL5053
R7 220Ω
RN1
R10 22K
R18 680Ω
R16 2.2K
R14 220K
R17 680Ω
R15 2.2K
R13 220K
C8 10µf 35V
C7 .1µf 50V
C9 .0022
R12 1.2K
C5 30PF
R11 100K
D1 1N4148
D2 1N4148
R28 1.2K
R30 10K
R20 2.2K
R32 820Ω
R33 680Ω
R31 22K
R22 2.2K
R25 22K
R23 6.8K
R8 220Ω
R21 22K
R26 220K
R24 2.2K
R27 3.6K
R9 220Ω
Q1 MPS A14
R2 5.6K
R5 330Ω
R4 100Ω 24 TURN
R3 82Ω
C2 2.2µf 25V
C3 10µf 35V
C1 .1µf
R6 470Ω
D4 HSL5053
TO4NS1 VR3
EXTERNAL WALL TRANSFORMER
TR1 PS7203
D6 KBP005
C14 1500µf 25V
C13 10µf 35V
C17 .1µf 50V
78L12 (TO-92)
VR1
C12 10µf 35V
C15 .1µf 50V
7805 (TO-220)
VR2
C18 10µf 35V
C4 .1µf 50V
+5
+12
+16

NOTE:

1) ALL RESISTORS 1/4 W 5% CF.

2) ALL CAPACITOR ≥ 10µf ARE ALUMINUM ELECTROLITIC.

3) ALL CAPACITOR < 10µf ARE MONOLITHIC OR CERAMIC.

ICT	DEVICE	+12	+5	GND
1	74LS16		14	7
2	80C98	16		8
3	74LS241		20	10
4	LF253	8		4
5	LM339	3		12

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES
ANGLES ±1°
FRACTIONS ±1/64
3 PLC DEC ±.005
2 PLC DEC ±.01

INTERPRET THIS DWG
PER USA STANDARDS

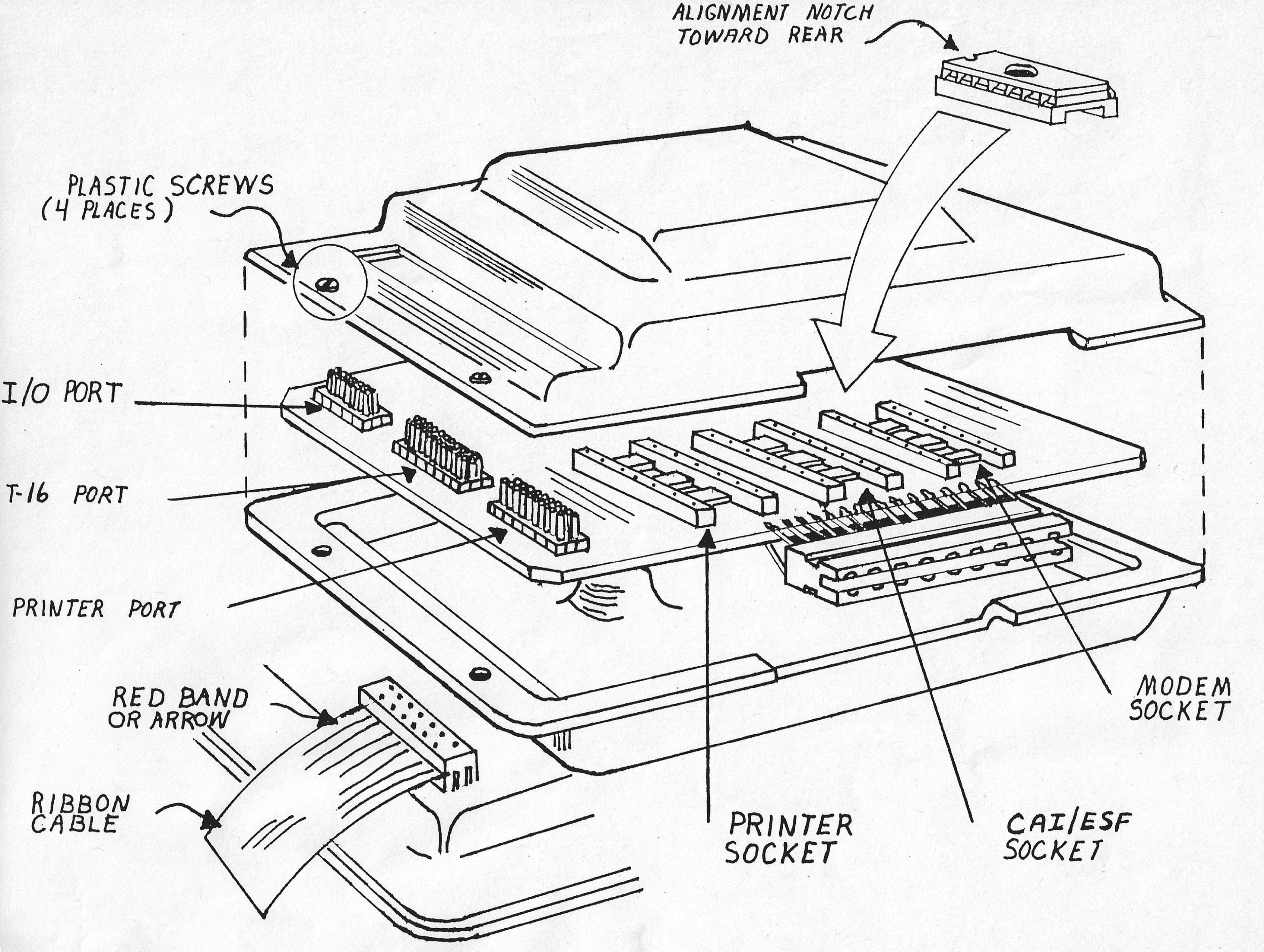
NEXT ASSY | USED ON
APPLICATION
MATL
FINISH

SIGNATURE AND DATE
DRAWN Howell 8-17
DRFTG CHK
DESIGN CHK
PROJ ENGR
APVD

exatron

TITLE
SINCLAIR STRINGY FLOPPY

SIZE D
DRAWING NO 1000-1400
SCALE NONE
SHEET
OF


ALIGNMENT NOTCH TOWARD REAR
PLASTIC SCREWS (4 PLACES)
I/O PORT
T-16 PORT
PRINTER PORT
RED BAND OR ARROW
RIBBON CABLE
PRINTER SOCKET
CAI/ESF SOCKET
MODEM SOCKET

USE THIS FORM TO ORDER YOUR CAI/ESF WAFERS

SEND CHECK, MONEY ORDER, VISA/MASTERCARD NUMBER TO:

CAI INSTRUMENTS INC
PO BOX 2032
MIDLAND, MI 48640 (517)687 7343

MASTERCARD____________________ VISA____________________

EXP DATE__________

NAME____________________________ PLEASE PRINT

ADDRESS________________________ CITY________________

STATE______________ ZIP__________

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QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
	5 ft 8K	2.95	
	10 ft 14K	3.25	
	20 ft 29K	3.95	
	35 ft	4.25	
	50 ft	4.95	
	SALES TAX (MICH RESIDENTS) 4%		
	SHIPPING & HANDLING CHARGES		2.50
	TOTAL AMOUNT OF ORDER		

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